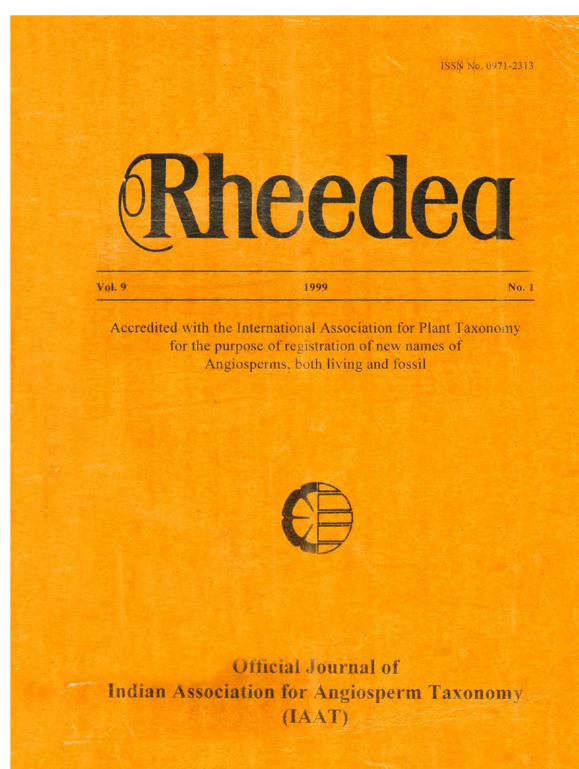




## Chemotaxonomy of Some Indian *Clerodendrum* L.

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## **Chemotaxonomy of Some Indian *Clerodendrum* L.**

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### **Abstract**

A comparison of chemical constituents in the leaves of eleven taxa of *Clerodendrum* L. is studied. In all 26 chemical compounds were detected and were statistically evaluated for their interrelationships. Present study shows that chemically 4 groups have evolved in *Clerodendrum*. The conclusions have been compared with the delimitations of the taxa proposed in earlier classifications. The groups presently arrived at are distinct and agree partially with Moldenke's subgeneric treatment.

### **INTRODUCTION**

Earlier information on chemical studies in the genus *Clerodendrum* is extensive (Banerjee, 1936; Barton *et al.*, 1961; Bhakuni *et al.*, 1962; Sankarasubramanian and Nair, 1972; Abdul Alim, 1971; Sankarasubramanian, 1973; Nair *et al.*, 1979; Gibbs, 1974; Chaudhary & Roy, 1979; Hegnauer and Kooiman, 1978; Reddy *et al.*, 1988) but with meagre taxonomic interpretation. Hence, presently a qualitative comparison of chemical constituents is undertaken to assess the interrelationships in eleven taxa of *Clerodendrum*.

### **MATERIALS AND METHODS**

Fresh leaves (100 grams) of each species was refluxed with 95% ethanol for 90 minutes. The extract was cooled and filtered. The extract was treated with animal charcoal powder to remove chlorophyll and then was concentrated. The extracts along with two identified compounds (Clerodin = CI-1, Clerodin hemiacetal = CI-2) was chromatographed on a TLC plate, using chloroform-methanol (8.5:1.5) as solvent system. TLC plates were coated with silica gel. Subsequent to drying the plates were activated in the oven at 110°C for 1 hour. The TLC plate was sprayed with concentrated H<sub>2</sub>SO<sub>4</sub> and heated in hot-air oven at 95°C. In making the overall assessment of the constituents, Colour of spot (developed) and R<sub>f</sub> values are taken into consideration (Table 1, Figs. 1, 2) and not their exact chemical nature. Following Ellison *et al.* (1962) paired affinity values (PAV) for all the species were calculated and represented in polygon graphs (Table 2, Fig. 3).

## RESULTS AND DISCUSSION

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I = *C. aculeatum*; II = *C. calamitosum*; III = *C. indicum*; IV = *C. inerme*; V = *C. minahassae*; VI = *C. neriifolium*; VII = *C. philippinum*; VIII = *C. phlomidis*; IX = *C. serratum*; X = *C. splendens* and XI = *C. viscosum*. + = Present; - = Absent.

The present information on chemical analysis was statistically evaluated. Based on the paired affinity values (PAV) (Table 2) and cluster analysis (Fig. 4), the taxonomic position is discussed hereunder.

From the Table 2 and Figs. 3 and 4, it is evident that 11 taxa presently studied fall into the following 4 groups. Group I includes *C. calamitosum* and *C. indicum* with a relationship of 92%. Group II consists of *C. aculeatum*, *C. minahassae*, *C. philippinum*, *C. phlomidis*, *C. serratum*, *C. splendens* and *C. viscosum* with a relationship of 56.5 to 92%. While Group III consists of *C. inerme* and Group IV of *C. neriifolium* with 32% and 50% relationship respectively (Fig. 4 and Table 2).

Table 2. Paired affinity values of *Clerodendrum* L. species studied based on distribution of their chemical constituents

| Sl. No. | Name of the species   | Species number |     |     |     |     |     |     |     |     |     |     |
|---------|-----------------------|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|         |                       | 1              | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  |
| 1.      | <i>C. aculeatum</i>   | 100            | 44  | 55  | 40  | 67  | 60  | 73  | 73  | 50  | 67  | 57  |
| 2.      | <i>C. calamitosum</i> |                | 100 | 80  | 22  | 36  | 44  | 40  | 40  | 18  | 36  | 30  |
| 3.      | <i>C. indicum</i>     |                |     | 100 | 36  | 46  | 55  | 50  | 50  | 31  | 46  | 40  |
| 4.      | <i>C. inerme</i>      |                |     |     | 100 | 33  | 40  | 36  | 36  | 17  | 33  | 29  |
| 5.      | <i>C. minahassae</i>  |                |     |     |     | 100 | 50  | 77  | 77  | 57  | 71  | 62  |
| 6.      | <i>C. neriifolium</i> |                |     |     |     |     | 100 | 55  | 55  | 36  | 50  | 43  |
| 7.      | <i>C. philippinum</i> |                |     |     |     |     |     | 100 | 83  | 62  | 92  | 67  |
| 8.      | <i>C. phlomidis</i>   |                |     |     |     |     |     |     | 100 | 62  | 77  | 67  |
| 9.      | <i>C. serratum</i>    |                |     |     |     |     |     |     |     | 100 | 58  | 50  |
| 10.     | <i>C. splendens</i>   |                |     |     |     |     |     |     |     |     | 100 | 63  |
| 11.     | <i>C. viscosum</i>    |                |     |     |     |     |     |     |     |     |     | 100 |

Bentham and Hooker (1865) split the genus into five subgenera and two of the present species viz., *C. aculeatum* and *C. inerme* have been kept under subgenus *Volkameria*. Clarke (1876) divided the genus into two sub-genera *Euclerodendron* and *Siphonanthus*, and *C. indicum* was kept in the latter while the rest five under the former. De Candolle (1825) divided the genus into two sections viz. *Euclerodendron* and *Siphonanthus*. The former was further subdivided into 4 sub-sections. He placed *C. indicum* in section *Siphonanthus* and the rest under various sub-sections of section *Euclerodendron*.

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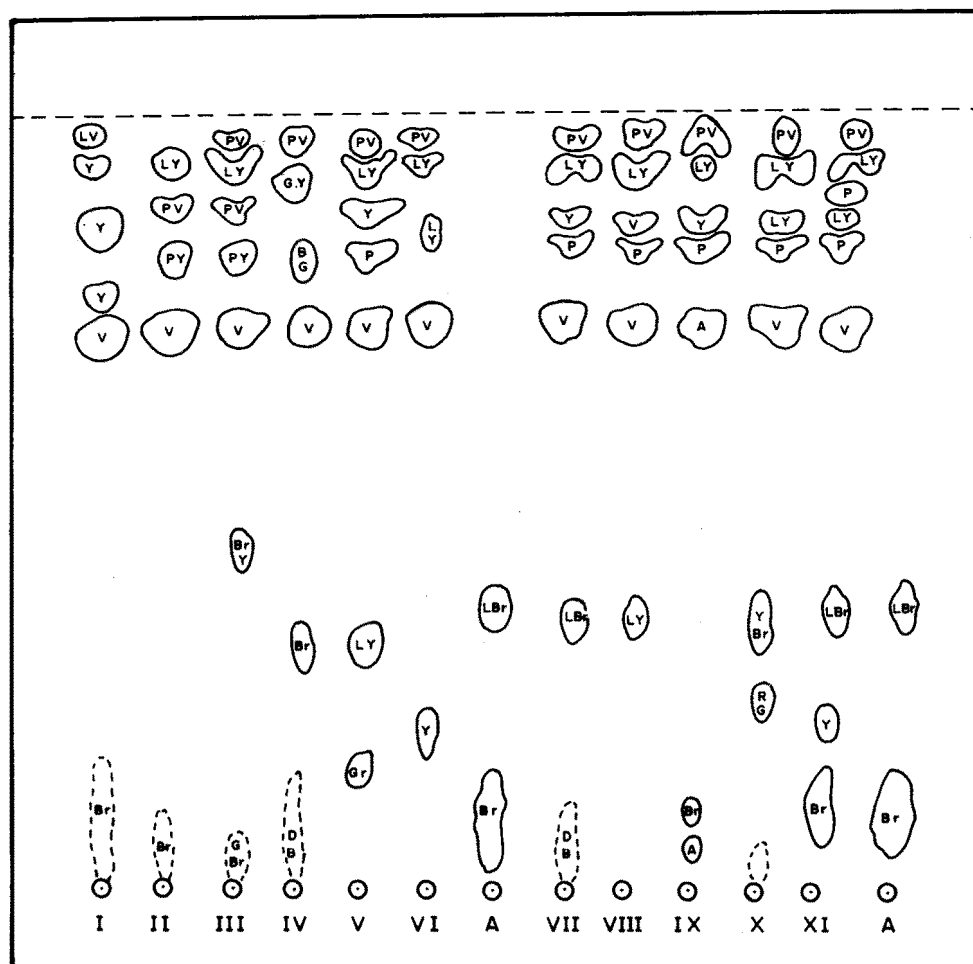


FIG. 1

Fig. 1. Thin layer chromatogram of the leaf extracts of eleven species of *Clerodendrum* spotted along with the mixture of Clerodin (CI-1) and its hemiacetal (CI-2) (A) depicting their colours (for details refer Table 1). I to XI, species number (see Table 1).

br = Brownish red; Br = Brown; Gr = Green; Y = Yellow; RG = Reddish green; LY = Light Yellow; L. Br = Light brown; Br. Y = Brownish yellow; V = Violet; A = Ash; BG = Bluish green; Py = Pinkish yellow; P = Pink; Pv = Pinkish violet; Gy = Greenish yellow; DB = Dark blue; G. Br = Brownish green.

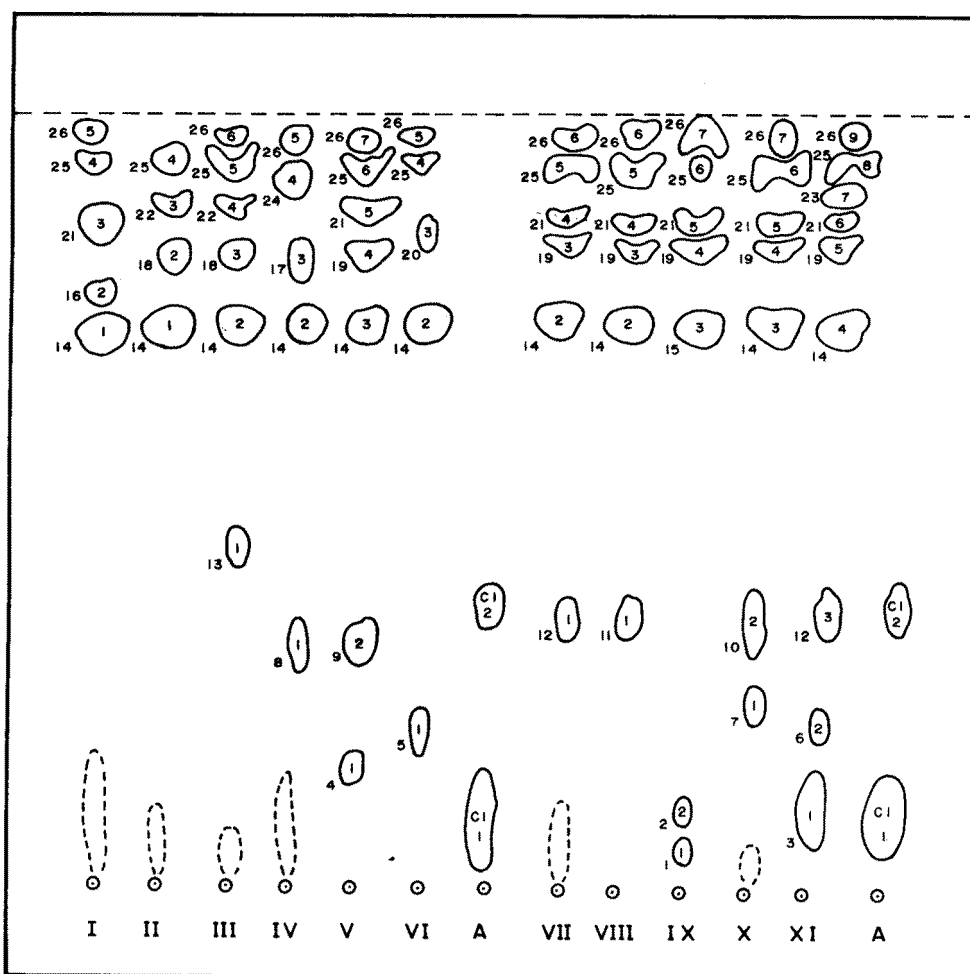
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FIG. 2

Fig. 2. Thin layer chromatogram of the leaf extracts of *Clerodendrum* studied depicting the number of compounds (spots) and separated constituents in each species along with A, mixture of CI-1 (Clerodin) and CI-2 (Clerodin hemiacetal) I-XI (species number). The numbers outside the spot indicate compound number from the total pool. The numbers inside the spot represent spot numbers of the individual taxa from the origin to the solvent front.

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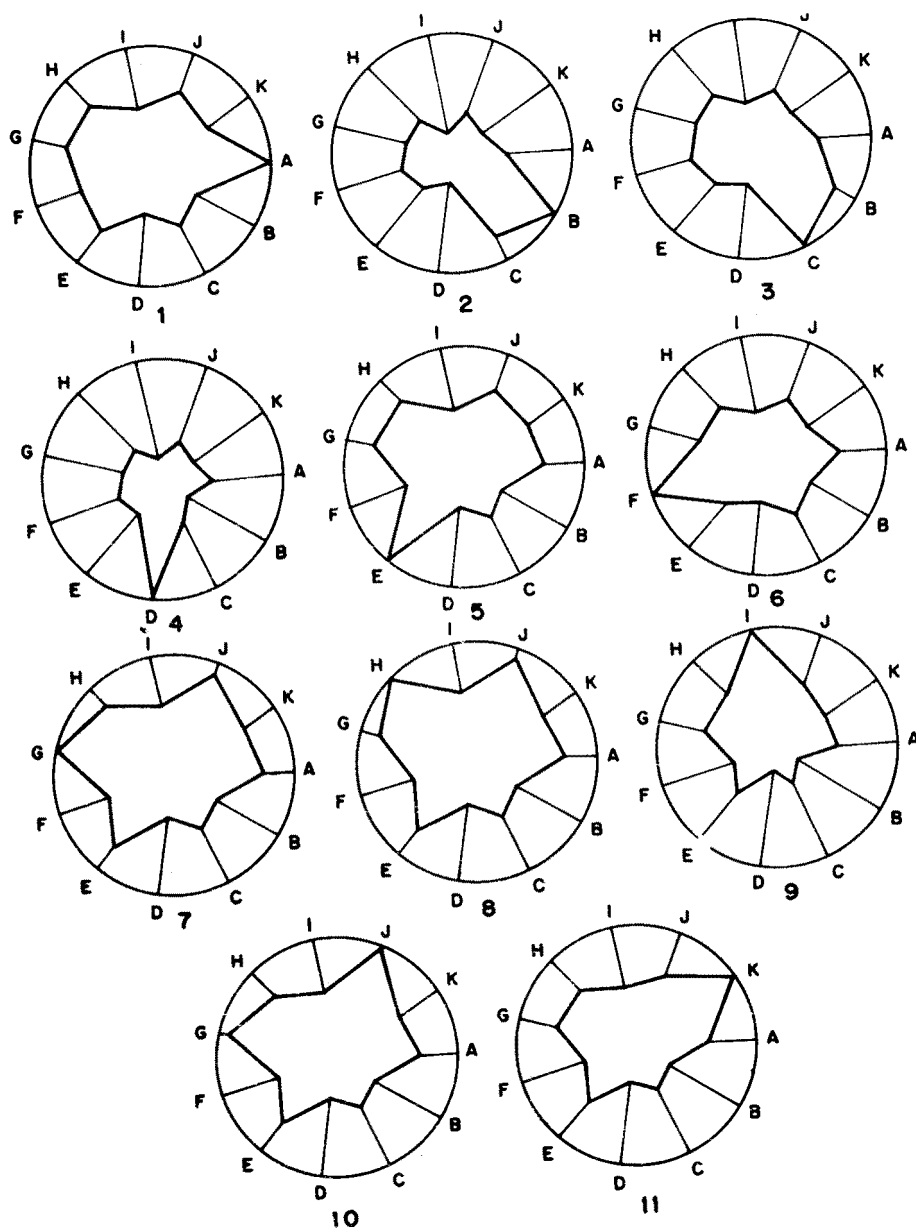


FIG. 3

Fig. 3. 1-11, Polygon patterns in the *Clerodendrum* species studied based on chemical characters.

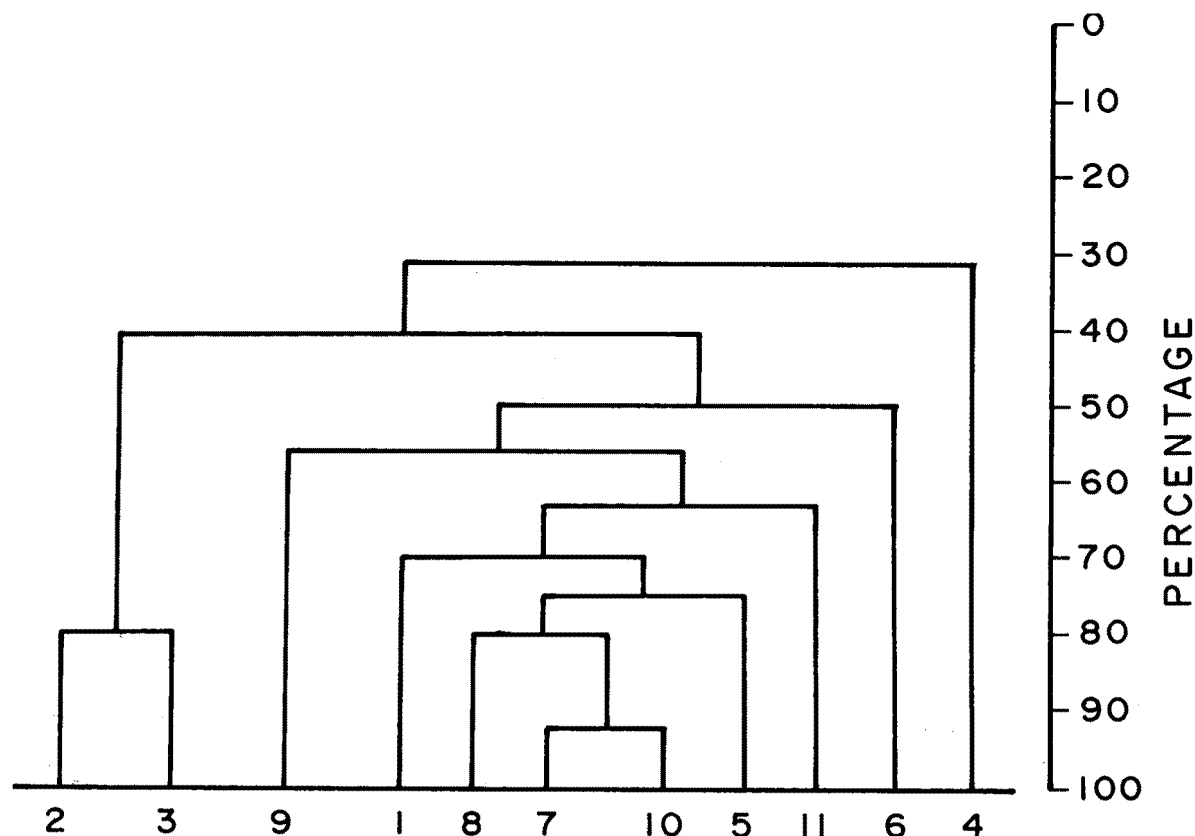
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FIG. 5

Fig. 4. Dendrogram representing relationships in the *Clerodendrum* taxa based on chemical characters.

Junell (1934) on embryological grounds divided the genus into five sections. *C. indicum* was kept under his section *Siphonanthus* and *C. aculeatum* in section *Volkameria*.

Moldenke (1959) elaborated the genus into five sub-genera, which were further divided into sections and sub-sections. *C. serratum* was kept in section *Stacheocymosa* (sub-genus *Cyclonema*) and *C. aculeatum* under sub-genus *Volkameria*. The rest of the nine species presently studied were placed under various sections and sub-sections of the sub-genus *Euclerodendron*. For instance *C. inerme*, *C. nerifolium*, *C. phlomidis* and *C. calamitosum* under section *Axilliflora*; *C. indicum* and *C. minahassae* in section *Siphonanthus*; *C. philippinum* and *C. viscosum* in

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sub-section Paniculata (section Microcalyx) and *C. splendens* under sub-section Acuminata (section Oxycalyx).

Chemotaxonomically, correlation between morphological and chemical characters in splitting the genus with reference to the alignment of *C. indicum* under Siphonanthus and the rest under Euclerodendron (Clarke, 1876) except *C. viscosum* as a third cluster was reported (Reddy *et al.*, 1988). Chaudhary and Roy (1979) revealed biochemical affinities among some taxa of Verbenaceae which also included 6 species of *Clerodendrum*. However, they have not discussed interspecific relationships in the latter based on their chemical data.

In the light of earlier investigations and also various subgeneric treatments in the genus, the conclusions drawn in the present study based on TLC analysis is distinct and agrees partially in certain circles of affinities proposed by Moldenke (1959). For instance, the treatment of *C. phlomidis*, *C. minahassae*, *C. philippinum*, *C. viscosum* and *C. splendens* under sub-genus Euclerodendron of the latter is in agreement with their grouping in the present group II (Table 2 & 3 Fig. 4). However, a study based on chemical parameters of eleven species of such a large genus (564 spp. Cf, Moldenke, 1971) is only an attempt to understand the relationships amongst the Indian representatives of the genus *Clerodendrum*.

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